AN LF-BAND TRANSMITTER

FOR TOP BAND AND EIGHTY METRES — CIRCUITRY AND CONSTRUCTION

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THE circuit used for this rig is basically that described in "Eighty Metres with a Top Band Transmitter" in the October, 1963, SHORT WAVE MAGAZINE. It is straightforward and reliable, running 8-12 watts on 1·8-2·0 mc and 3·5-3·8 mc. The cost of building is small and the finished appearance not unpleasing.

Fig. 1 is the transmitter circuit. V1 is a 6AM6 or equivalent, and the VFO tunes 1·75-2 mc by means of VC1, through a small ball drive. To avoid any difficulty with the VFO coil, a *Wearite PHF6* can be used. This is a fixed inductance coil, manufactured to a high degree of accuracy, and connections are made to it so that the two windings are in series. It is thus only necessary to adjust trimmer C18 for correct coverage. Other coils, modified to give suitable coverage if needed, could be used. But the PHF6 is an easy means of obtaining correct coverage without experiment. The VFO is operated from a stabilised 150v. supply.

A second similar stage acts as buffer/amplifier, and as doubler for 80 metres. L2 is broadly resonant at about 3·65 mc, and L3 at about 1·9 mc. The nuisance of home-wound coils or experimentation to obtain the correct coverage can be avoided by using *Osmor* QA5 *(Blue-blue)* coils in each position. For 160 metres, initially screw L3 core fully into the winding. Remove 31 turns from the other coil, for L2, re-solder the end, and set the core flush with the coil end.

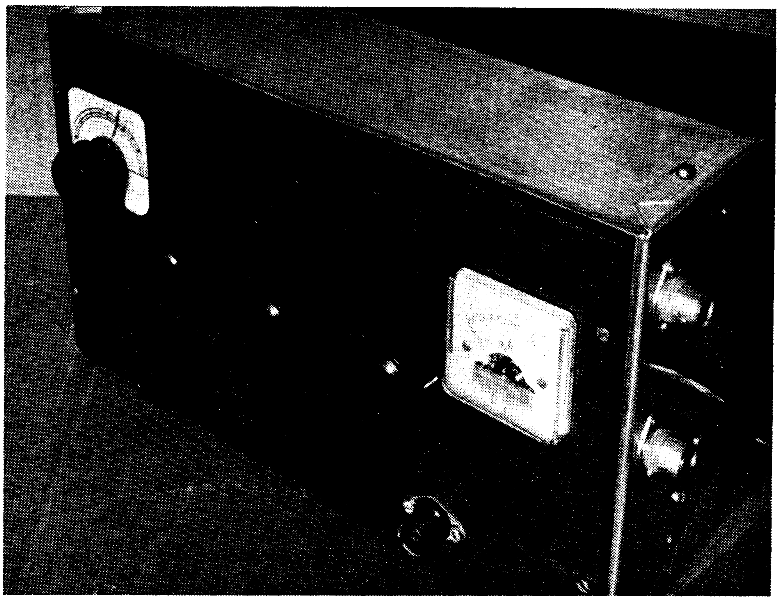
For the PA, V3, a 5763 is used, and grid current with the values shown was approximately 2 mA on 80 and 3 mA on 160 metres. This can be checked by placing a meter between R7 and chassis (positive to chassis). The usual *pi*-output circuit is employed, with a two-band coil L4; this consists of 70 turns of 24g. double-cotton-covered wire, side by side, centre tapped. Bandswitches S5 and S6 are separate, with small knobs, and both are rotated clockwise for 80 metre coverage.

Normal operating anode current for the PA is about 30-40 mA and a 0-100 mA or 0-50 mA meter will do. An 0-5 mA meter, shunted to read 0-50 mA, was actually fitted.

V4 is a high-gain two-stage amplifier, C14 and C15 being selected to lift response a little towards the higher frequencies. No gain control was provided, as modulation was about right with normal speaking into a crystal microphone, and it is not difficult to get accustomed to having the mike at a fixed distance.

V5 is the Class-A modulator, and the 6BW6 is adequate for this PA input. Any attempt to over-modulate causes bad distortion, not because of splatter but due to breaking the carrier. So reports of distorted speech indicate the need to get back from the microphone a little! The modulation choke Ch. can be an 80 mA or 100 mA mains pentode output transformer, with the secondary ignored. Temporarily connecting a speaker to the secondary is a good way to check the modulator section. (Keep the loud-speaker away from the mike.)

A 3-way switch provides for *net* (VFO and buffer on), *receive* (aerial switched to receiver) and *transmit*



General appearance of the 80/160m. Tx as built by G3OGR, which is only 10 inches on the maximum dimension. It is neat, compact and effective, and would be very useful as a No. 2 set, or for anyone just starting on the air.

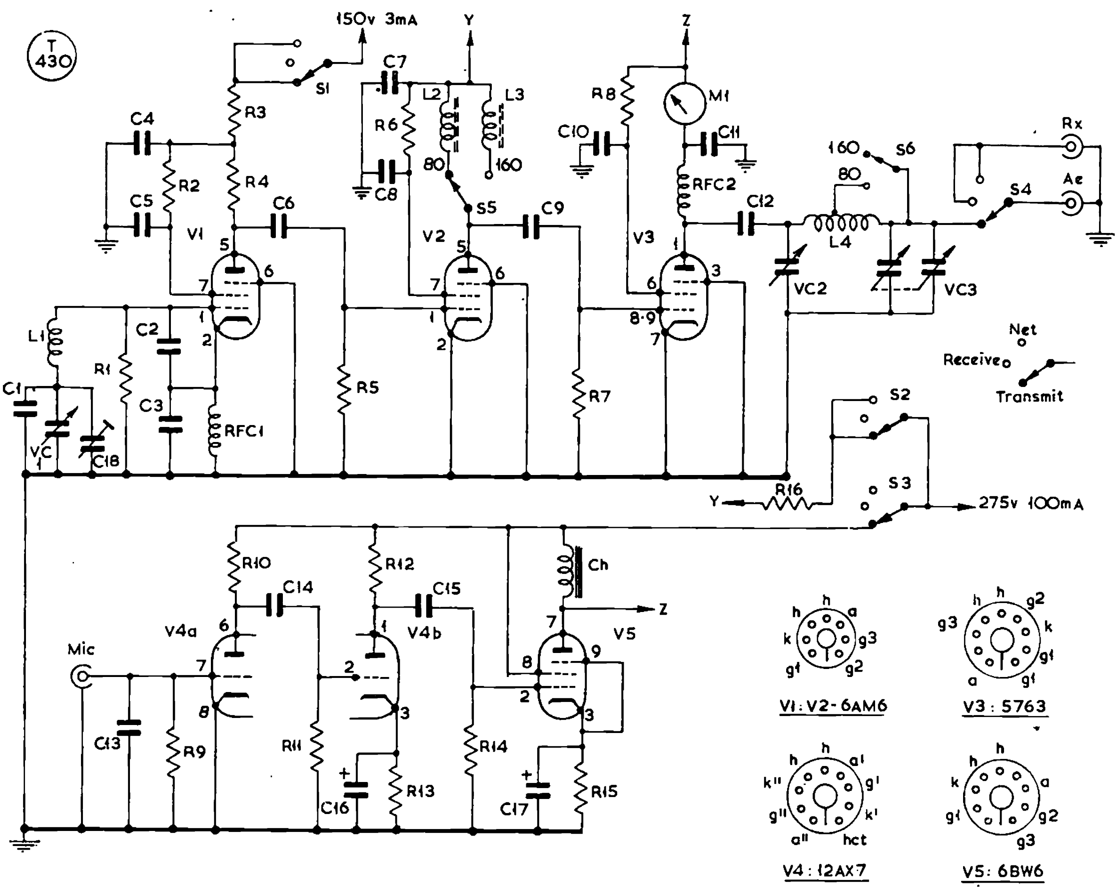


Fig. 1. Circuit complete of the VFO-BA-PA transmitter and modulator described and illustrated in the article. The PA (V3) is a 5763, a highly efficient miniature type, and the modulator (V5) is a 6BW6. The BA stage (V2) effectively isolates the VFO (V1) from the PA. With the exception of L4 (see text), commercial coils are used throughout. A transmitter built to this design would make a very handy job for 80/160m. working, or as a first Tx for a beginner starting on the air.

positions. Section S1 switches the VFO, S2 the buffer HT, S3 the modulator and PA, and S4 the aerial.

Chassis and Case

Fig. 2 is the layout on top of the chassis. A neat and inexpensive case is derived from a *Home Radio (Mitcham)* " universal chassis " measuring 10in. by 6in. by 3in. An extra 10in. by 3in. runner forms the chassis. Cut the corners of this so that it will fit inside the 6in. by 3in. runners. The chassis is bolted about four inches from the top of the panel. Most of the transmitter can then be assembled and wired. Cut and check large holes before matching any parts. A number of quarter-inch holes are also punched for ventilation and for leads.

[*over p.14*

Notes: Ch* can be primary of pentode-type speaker transformer. All resistors rated ¼-watt except where stated. Meter can be miniature 0-50 or 0-100 mA, or 0-5 mA shunted. Case is 10in. by 6in. by 3in. universal chassis, with 10in. by 3in. runner (*Home Radio*).

Table of Values

Fig. 1. Circuit of the LF-Band Transmitter

C1	= 56 μμF, 1%	R9, R11	= 1 megohm
C2, C3	= ·001 μF, 1%	R10	= 220,000 ohms
C4, C7, C8	= ·01 μF	R13	= 1,000 ohms
C5, C10, C11, C14	= ·002 μF	R14	= 470,000 ohms
C6, C9, C13	= 100 μμF	R15	= 270 ohms, 1w.
C12	= ·001 μF	R16	= 4,700 ohms, 1w.
C15	= ·005 μF	RFC1	= 2·5 mH, min.
C16	= 50 μF, 6v.	RFC2	= 2·5 mH, 60 mA
C17	= 50 μF, 50v.	L1	= PHF6, *Wearite*
C18	= 30 μμF trimmer	L2, L3	= QA5, *Osmor*
VC1	= 30 μμF, tuning	L4	= *see text*
VC2	= 300 μμF, tuning	Ch	= 100 mA choke*
VC3	= 500+500 μμF, BC 2-gang, load	S1, S2, S3, S4	= 4-pole, 3-way rotary
R1	= 68,000 ohms	S5	= 1-pole, 2-way rotary
R2	= 47,000 ohms	S6	= SP on-off
R3	= 2,200 ohms	V1, V2	= 6AM6, EF91, 8D3 or similar
R4, R7	= 22,000 ohms	V3	= 5763
R5, R12	= 100,000 ohms	V4	= 12AX7, ECC83
R6	= 33,000 ohms	V5	= 6BW6
R8	= 5,600 ohms, 2w.		

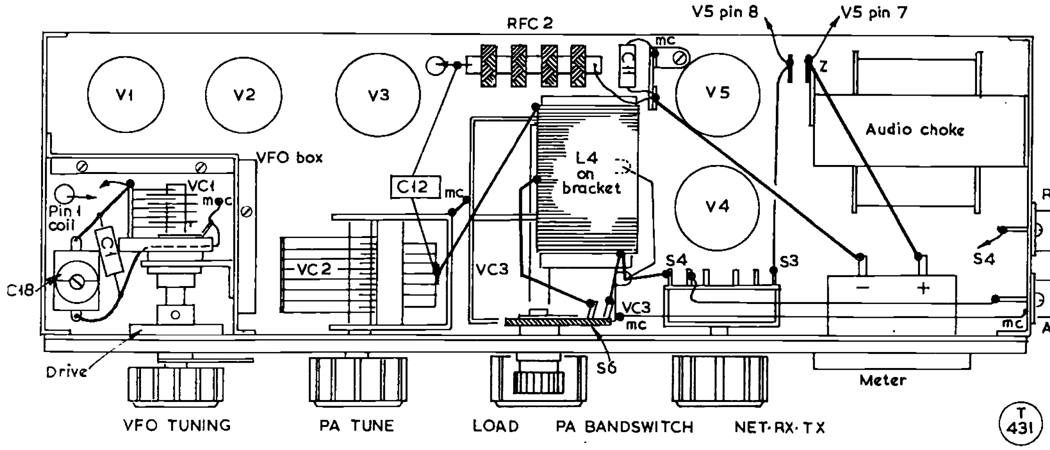


Fig. 2. Upper chassis layout for the transmitter described in the article. By using the chassis dimensions recommended and keeping fairly closely to this plan, a compact and efficient parts arrangement would be achieved.

VC2 can be about 250 $\mu\mu$F to 500 $\mu\mu$F and was a non-miniature air-spaced capacitor as used for receiver tuning. VC3 is a 2-gang capacitor with its sections in parallel; a 2/365 $\mu\mu$F or similar condenser could be used, but occasionally the extra capacity given by a 2/500 $\mu\mu$F condenser could be useful. With fairly large capacitors, and L4 switched, loading into most normal aerials or tuners is easy.

The audio choke (speaker transformer) is mounted to one side, which also carries two coax sockets, for aerial and receiver; these sockets were actually one over the other. A small tag strip supports C11. V1, V2 and V4 need cans. The use of cans on V3 and V5 seems optional.

VFO Box

The VFO screening box is essential for Top Band. It is bent from aluminium, and bolted to the panel and chassis. VC1 is on a strong bracket. L1 is below VC1, a 6BA bolt through the panel going into its tapped hole. C18 is bolted to the chassis, and can be reached through a hole in the box top.

When the VFO is wired, bolt on the 6in. by 3in. side, which further strengthens it. A small plate is secured on top of the box with self-tapping screws. The ball-drive lug is bolted to the panel, and a small pointer travels over a scale, later calibrated.

Under the Chassis

Fig. 3 shows the under-chassis wiring. A tag strip provides anchorage for the power supply leads and some other items. The microphone socket connection did not need screening, but runs against the chassis. (The external microphone lead must of course be screened.)

The heater circuit, tags X, is wired first. Keep

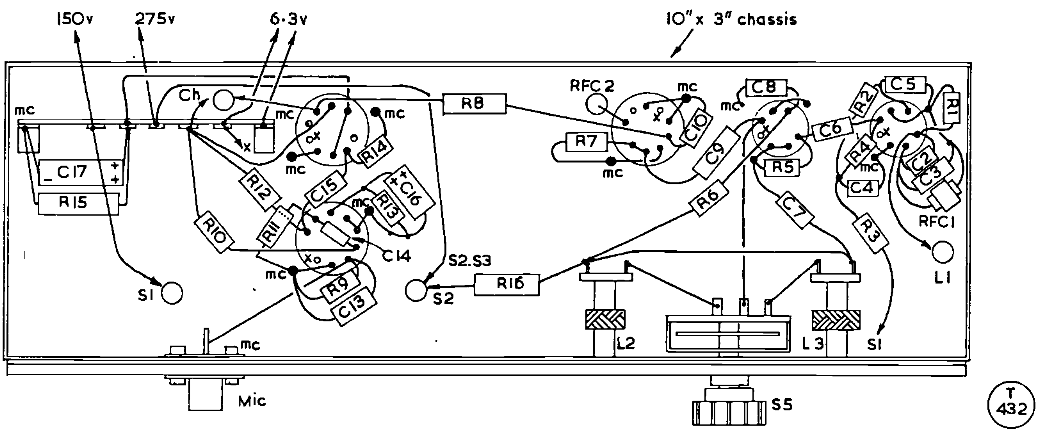
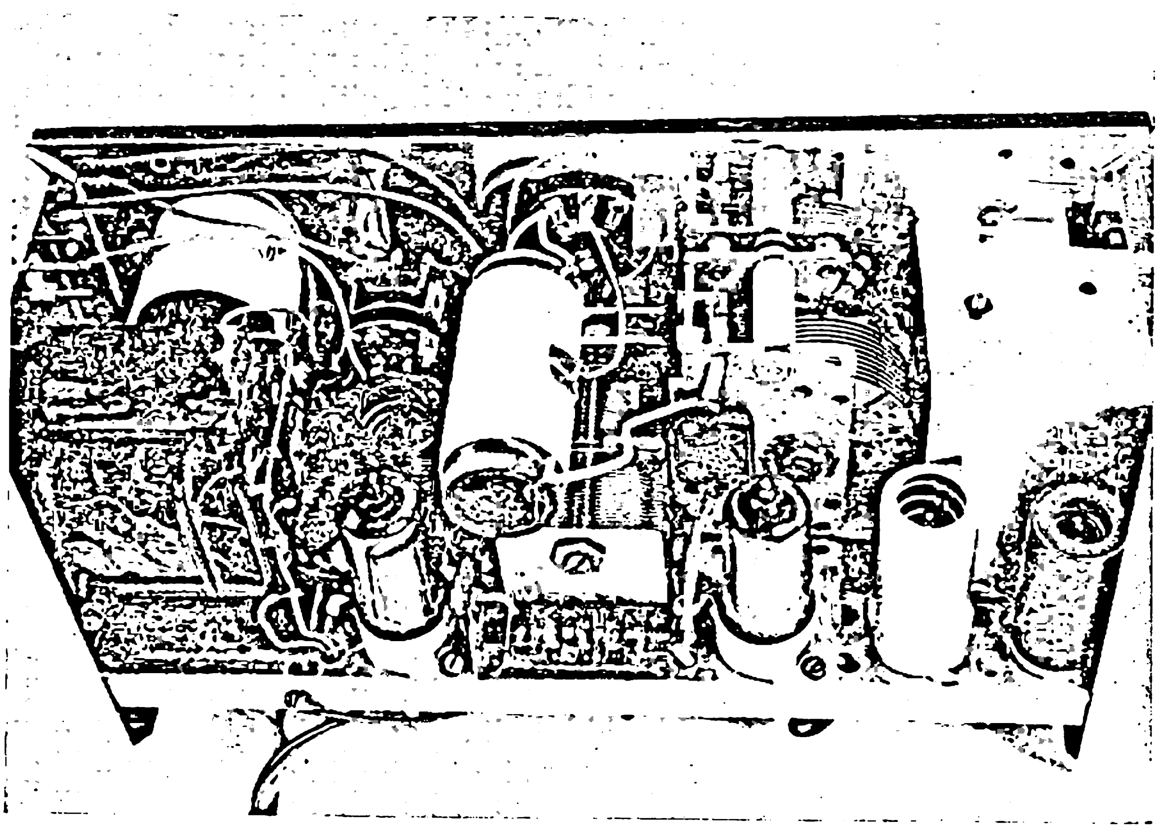


Fig. 3. Underneath the chassis, showing positioning of the coils L2, L3 and several of the minor components. If working to the layout exactly as described, this drawing and that at Fig. 2 identifies all parts, while the general arrangement and final appearance can be checked from the photographs.



Inside the 160/80m. transmitter, showing general layout and construction. The VFO section is in the screened compartment on the right, with the PA tuning condenser VC2 next in view. The valves visible, from right to left, are V1, V2, V3 (the RF section) and V5 (modulator).— see circuit diagram Fig. 1 and layout sketch Fig. 2. The iron-cored component at left front is the modulating choke, with the panel meter (white case) immediately behind. The switched coil L4 is the central winding, and the load capacity VC3 is immediately below.

these and HT connections against the chassis. C6. C9, and similar parts in the RF circuits are placed as directly as possible. The cores of L2 and L3 can be reached from behind. Small disc or tubular ceramic capacitors are most easily accommodated.

Adjustments

VFO coverage can be checked, but calibration is left until last. Accurate calibration is possible with a receiver and 100 kc crystal marker. With the switch at "net" the VFO is adjusted to zero beat at 2 mc in the receiver, with VC1 nearly open. This is achieved by rotating C18. Then 1·75 mc will be found at 3·5 mc on the receiver (VFO harmonic) with VC1 nearly closed.

Calibrate first at 1·8, 1·9 and 2·0 mc. Then 1·8 is also 3·6 mc, and 1·9 is also 3·8 mc. Tune the receiver to the 100 kc crystal marker beats at 3·5 and 3·7 mc, to calibrate the VFO for these frequencies. (The 50 kc points can be put in by tuning the receiver through 7 mc, etc.) The 10 kc points can be inserted by eye.

VC1 was the easily obtainable small SW type of tuning condenser having 9 plates on the rotor. A 75 $\mu\mu$F condenser was originally fitted, and plates were removed one by one until the coverage was 1·75-2·0 mc with a little rotation unused each end of the bands. The capacitor then had 5 moving and 6 fixed plates left, and was measured as approximately 30 $\mu\mu$F.

Put a meter in between R7 and chassis. With the VFO at 1·9 mc and S5 at 160m., rotate the core of L3 for maximum grid current. Repeat with L2, with S5 set for 80m. and the VFO at 3·65-3·7 mc. Any grid current between about 2 mA and 3 mA is satisfactory. If necessary, the value of R6 can be changed to raise or lower grid current. This should not be necessary.

Panel

A varnished plywood sheet the same size as the aluminium panel was fitted to cover the numerous bolt heads. Knobs, microphone socket, and meter have to be removed. The panel is held by the meter bolts, mike socket, and the two bolts each side which go into the 6in. by 3in. members. Control bushes and nuts rest in clearance holes. The remaining

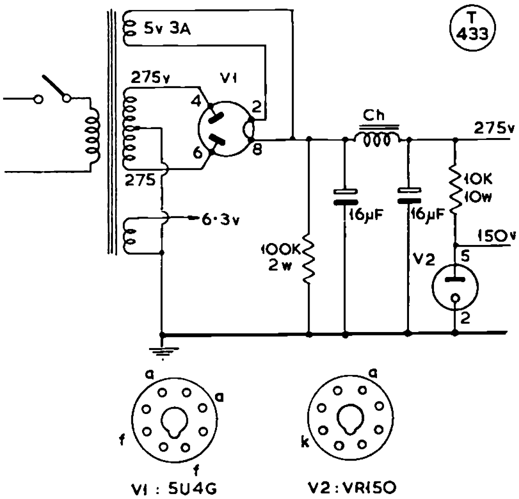


Fig. 4. A suitable power supply unit for the 80/160m. transmitter described by G3OGR in his arcticle.

panel bolts were round-headed, so depressions to suit were made in the rear of the panel with a countersink bit. Drilling positions can be found by putting ink or paint on the bolt heads, and pressing the wooden panel on to these marks.

Power Supply

It may be possible to use an existing 250-300v. pack. Heaters require 2·1 amps. at 6·3v. The VFO drain is under 5 mA, preferably regulated. Reasonable results can be expected with a 80 mA 250v. supply, but a pack maintaining the full 275v. or a little more, at 100 mA, allows a larger input.

If the HT supply is a little meagre, a radio-frequency output meter will show that RF tends to fall off when loading raises the PA anode current above 30 mA or so. With an adequate HT voltage, RF output continues to increase. Insufficient grid drive (low grid current) gives a similar effect. Maximum input for the 5763 is 50 mA at 300v. (15 watts) but an input of between about 8 watts and 12 watts seems most satisfactory.

PA input is, of course, Anode Voltage *x* Anode Current. So 30 mA at 300v. would be 9 watts, while 40 mA at 250v. is 10 watts. Top Band input loading should not exceed 10 watts.

Fig. 4 shows a suitable power supply. The VR150 could be an OA2. A transformer and choke of adequate rating help to maintain the voltage on load.

Operating Notes

A newly-licensed operator may welcome a few working details. A first test can be made with a 15 watt 200/250 volt household lamp connected across VC3, or to the aerial socket by a spare coax plug. A short aerial lead from the receiver can be placed near the lamp.

S5 and S6 must always be set for the same band. With the switch at "net" find the carrier on the receiver. Then with the switch at "transmit" and VC3 closed, rotate VC2 for a dip in anode current. Open VC3 progressively, restoring the dip with VC2, until the meter shows the required input (30-40 mA). This is best done with two hands. The bulb should then light fairly brightly.

With the receiver RF gain well back, speech in the microphone should be clearly heard in the speaker. (Avoid feedback to the mike which will cause "howling round the loop.")

Working into an aerial involves the same procedure. Some 75-ohm coax with a plug connects the receiver to the transmitter Rx socket. A dipole for 80m. can be plugged directly into the aerial socket.

Many random length end-fed aerials can be worked directly from the transmitter. Load up into the aerial in the same way as described with the lamp. A good earth is helpful with end-fed aerials. End-fed wires can be used on either band. Should an ATU be employed, fit a short coax lead from the transmitter to this.

The "net" position is used either to tune the VFO to a clear channel found on the receiver, or to allow the VFO to be set up on the frequency of another station, to which a reply is made.

A solid metal plate back must *not* be used on the case. But a back cut from expanded metal, small mesh wire-netting, or similar material, can be fixed to the back with self-tapping screws.